

1753?

CLEVELAND PUBLIC LIBRARY
BUSINESS INF. BUR.
CORPORATION FILE

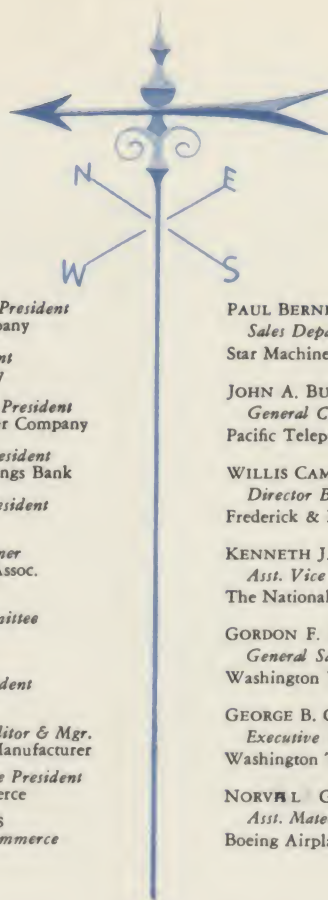
*The impact of World War II subcontracting
by the BOEING AIRPLANE COMPANY
upon Pacific Northwest Manufacturing*

MRB
Corp file

Induced by aircraft



JAN - - 1957



business executives' advisory board

PAUL P. ASHLEY, *Attorney*
Tanner, Garwin and Ashley

EDWARD W. ALLEN, *President*
Pacific Northwest Trade Ass'n

WILLIAM ALLEN, *President*
Boeing Airplane Company

RALPH BAKER, *President*
Standard Oil Co. of B. C.

DEAN BALLARD, *Secretary-Manager*
Distributors Ass'n of Seattle

TOM BANNON, *President*
Western Gear Works

JAMES W. CLISE, *President*
J. W. Clise and Company

HOLLIS DAY, *President*
Day's Tailor-d Clothing, Inc.

JUDD DAY, *Executive Vice President*
Day's Tailor-d Clothing, Inc.

FRANK L. DOBBINS
Materiel Manager
Boeing Airplane Company

WILLIAM E. DRAPER, *President*
W. E. Draper and Company

KENNETH FISHER
Treas. and Asst. Gen. Mgr.
Fisher Flouring Mills Company

CHARLES F. FRANKLAND, *President*
The Pacific National Bank

N. HENRY GELLERT, *President*
Seattle Gas Company

HENRY C. GLAZE
Ch. Industrial Committee
Pacific Northwest Trade Ass'n

FRANK JEROME, *Vice President*
Seattle First National Bank

D. C. KNAPP, *Executive Secretary*
Pacific Northwest Trade Ass'n

D. K. MACDONALD, *President*
D. K. MacDonald and Company

HAROLD MANSFIELD, *Director of*
Public Relations and Advertising
Boeing Airplane Company

PAUL B. MCKEE, *President*
Pacific Power & Light Company

RODERIC N. OLZENDAM
Industrial Consultants

HARLAN I. PEYTON, *President*
Peyton Investment Company

VICTOR RABEL, *President*
Star Machinery Company

KINSEY M. ROBINSON, *President*
Washington Water Power Company

DIETRICH SCHMITZ, *President*
Washington Mutual Savings Bank

IRVING SMITH, *Vice President*
Continental, Inc.

IRVING STIMPSON, *Partner*
Frederick E. Baker and Assoc.

P. A. STRACK
Chairman Exec. Committee
People's National Bank
of Washington

WILLIAM STREET, *President*
Frederick & Nelson

WILLIAM C. WHITE, *Editor & Mgr.*
Wash. Purch. Agent & Manufacturer

ROSS P. WILLIAMS, *Vice President*
National Bank of Commerce

W. WALTER WILLIAMS
Under Secretary of Commerce

business executives' research committee

PAUL BERNER
Sales Department
Star Machinery Company

JOHN A. BURLEIGH
General Commercial Engineer
Pacific Telephone & Telegraph Co.

WILLIS CAMP
Director Business Research
Frederick & Nelson

KENNETH J. CLARK
Asst. Vice President
The National Bank of Commerce

GORDON F. DEFOE
General Sales Supervisor
Washington Water Power Co.

GEORGE B. GARBER
Executive Vice President
Washington Tide Insurance Co.

NORVAL L. GRIGG
Asst. Materiel Manager
Boeing Airplane Co.

RICHARD HADLEY
Partner
Hadley & Hadley

HARRY HALLOWELL
Asst. Cashier
The Pacific National Bank

D. ROBERT HAYWARD
Sales Manager (Tacoma)
Griffin Fuel Co.

AL HILL
Asst. to the Public Relations Director
Boeing Airplane Co.

W. R. LINDERSMITH
Asst. Director of Purchases
Pacific Car & Foundry Co.

CHARLES W. LOOMIS
President
Loomis Armored Car Service

ALBERT L. MCALLISTER
Credit Analyst
Seattle-First National Bank

HARRY L. ROSS
Asst. Vice President
Marsh & McLennan, Inc.

SAMUEL SUGARMAN
(Lieutenant, J.G.)
(U.S. Navy—Military Sea
Transportation Service)

DON WALTERS
Managing Engineer
Inland Empire Industrial
Research, Inc.

ROBERT DENNY WATT
President
Electro-Watt, Inc.

R. C. WORL
Application Engineer
Western Gear Works

university of washington

HENRY SCHMITZ, *President*

H. P. EVEREST, *Vice President*

COLLEGE OF BUSINESS ADMINISTRATION

AUSTIN GRIMSHAW, *Dean*

EDWARD G. BROWN
Executive Officer
Department of Policy,
Personnel and Production

HENRY A. BURD
Executive Officer
Department of Marketing,
Foreign Trade and Transportation

JOSEPH DEMMERY
Executive Officer
Department of General Business

DONALD H. MACKENZIE
Executive Officer
Department of Accounting,
Finance and Statistics

FACULTY ADVISORY COMMITTEE

NATHANAEL H. ENGLE, *Director*
Bureau of Business Research

STANLEY E. BRYAN
Professor of Policy,
Personnel and Production

KERMIT O. HANSON
Assoc. Professor of Accounting,
Finance and Statistics

ALBERT N. SCHRIEBER
Assoc. Professor of
Production and Policy

WILLIAM J. STANTON
Assoc. Professor of Marketing

RESEARCH COORDINATOR OF THE SUBCONTRACTING STUDY

EARL GODDARD, *Research Asst.*
Bureau of Business Research

foreword

1100 B 1.25
This study of Pacific Northwest subcontractors of Boeing Airplane Company during World War II is the first report of the college-community research center sponsored by the Bureau of Business Research, University of Washington, and financed by grants from the Committee for Economic Development and the Fund for Adult Education of the Ford Foundation.

The actual research and the preparation of the report was done by a group of Pacific Northwest business executives, organized into a Business Executives' Research Committee, with Mr. Earl Goddard of the staff of the University's Bureau of Business Research serving as research coordinator.

Preliminary planning, including the selection of the research committee, was done jointly by a Business Executives' Advisory Board and a Faculty Advisory Committee for the College of Business Administration of the University of Washington.

One of a series of studies undertaken by the University of Washington, this project was designed to explore the

impact of Boeing Airplane Company's subcontracting during World War II on the economy of the Pacific Northwest and to uncover facts of importance to Boeing and to the subcontractors in future planning of similar work. At the same time the study has been an experiment in business-education cooperation in the investigation of business and economic problems. Other similar projects here and elsewhere throughout the nation are designed to test thoroughly the cooperative research technique.

We deeply appreciate the splendid cooperation we have had from the businessmen who worked with us on this project. The active interest and support of Austin Grimshaw, Dean, College of Business Administration, have contributed greatly to the success of the project. We are particularly fortunate in having had the service of Mr. Earl Goddard, on leave from the faculty of Oregon State College, to serve as coordinator of the research. We appreciate also the helpful assistance of the staff of the Bureau of Business Research.

NATHANAEL H. ENGLE
Director, Bureau of Business Research



table of contents

	Page		Page
PART I			
Introduction			
Purpose of the study.....	6	Problems encountered by subcontractors at the beginning of World War II	30
Importance of the Boeing Airplane Company to the Pacific Northwest	9	Wartime increase in subcontractor employment	32
Volume of Boeing subcontracting	9	Wartime operating problems of subcontractors- management	32
Boeing subcontracting in the Pacific Northwest	10	Wartime operating problems of subcontractors- plant and equipment	33
Definition of subcontracting	13	Wartime operating problems of subcontractors-changes in financial requirements	33
Boeing reasons for utilizing subcontractors	16	Amount of help furnished by Boeing to its Northwest subcontractors	35
Criteria for selection of subcontractor	17	Extent to which Boeing subcontractors in the Northwest served other prime contractors or defense agencies.....	36
The study procedure	20	Northwest firms which originated as Boeing sub- contractors	38
PART II			
Boeing World War II Subcontracting in the Pacific Northwest		Preference of Boeing subcontractors to act as prime contractors or as subcontractors.....	
Number of Pacific Northwest subcontractors	22	39	
Location of Northwest subcontractors	23	Postwar reconversion of Boeing subcontractors.....	
Classification of Northwest subcontractors by industry	23	41	
Classification of Northwest subcontractors by type of work done for Boeing	25	PART III	
Size of Northwest subcontractors	25	Conclusion	
Amount of prewar subcontracting experience.....	27	Some generalizations on Boeing subcontracting in the Northwest	
		44	
		The future of Boeing subcontracting in the Northwest.....	
		49	

Purpose of the Study...

The principal objective of this study is the analysis and evaluation of the impact of the Boeing Airplane Company's subcontracting policies and practices on manufacturing activity in the Pacific Northwest.¹ Boeing's Northwest subcontracting practices were chosen for study by the Business Executives' Research Committee for several reasons. The first, and perhaps principal, reason why the study was undertaken is that while Boeing subcontracting activity in the Northwest is frequently discussed by business men and others interested in the economic activity of the area, very little seems to be known of its general character and extent.

In addition, it was well known that during World War II a number of firms were created for the purpose of doing subcontract work for the Boeing Company. In several instances, these firms had been able to make a successful conversion to peacetime products and to continue in business. A major purpose of the study was, therefore, to ascertain just how many firms had been started as a consequence of Boeing work opportunities, and what their experience had been in the years following the conclusion of the war. A recent study of 69 Wichita, Kansas, wartime aircraft subcontractors indicated that about 40 of them, or 58 per cent, could be called *war babies*.² The Committee wished to know to what extent this relationship held true for Northwest subcontractors.

¹For this study, the Pacific Northwest is defined as the states of Washington, Oregon, and Idaho.

²Morgan, J. D. Postwar Experience of Wichita Subcontractors. *Bureau of Business Research, University of Kansas*. 1952. p. 10.

The third major reason for the study is related to the time period chosen for examination. The Boeing Airplane Company has been primarily a military aircraft producer during the past decade and a half. Since it was during the World War II period from 1941 through 1945 that Boeing subcontracting activities reached a level not approached during the prewar or immediate postwar years, this period was chosen for study by the Committee.¹ It was hoped by the Committee that the results of the study would be of value to the Northwest should such a period of all-out mobilization recur.

During times of rapid conversion from a peacetime to a wartime economy, available materials and manpower must be utilized as far as possible for military purposes. During such times many firms suddenly find themselves unable to produce their accustomed product. This was the experience of many Northwest firms during World War II. Many defense agencies, such as the Office of Production Management, the Smaller War Plants Corporation, and military procurement agencies made extensive efforts to relieve this so-called "priorities unemployment" by assisting businesses deprived of their normal product to obtain defense contracts. The Committee wished to discover to what extent Boeing had been able to assist Northwest firms to maintain their existence by making subcontract work available to them.

¹Boeing's subcontracting activities again reached a high level during the Korean emergency. Although this period could have been chosen for examination, it was felt that it could better serve to demonstrate the evolution of Boeing subcontract activities since World War II.



Olympia National Park, Washington



Sun Valley, Idaho

importance of the boeing airplane company to the pacific northwest

By any standard of measure the Boeing Airplane Company is one of the few very large industrial firms with both headquarters and major manufacturing facilities located in the Pacific Northwest. With a present employment of about thirty-seven thousand employees in its Seattle-Renton, Washington plants, the Company occupies an important place in the economic life of the Northwest area, and particularly, Seattle.

Each year the Company, through its payroll, the purchase of supplies and subcontracted parts, taxes and licenses, spends millions of dollars in the area. While the influence of all types of Boeing expenditures in the Northwest would be well worth extended examination, it is the purpose of this report to examine in detail one phase of Boeing's activities of special interest to Pacific Northwest manufacturers; namely, its policies and practices with regard to subcontracting.

volume of boeing subcontracting

A well established part of the Boeing Airplane Company's manufacturing policy has been to subcontract a portion of its work to other manufacturers. During periods of high level activity, subcontractors have been called upon to furnish a substantial portion of the parts required for the fabrication and assembly of Boeing aircraft. During the latter stages of World War II, when the production of B-29 bombers was at its height, approximately 49% of manufacturing expenditures went to subcontractors. After some decrease in subcontracting activity during the years following World

War II, increased production of military aircraft beginning in 1948 again brought the proportion of subcontracting up to its World War II level.¹

Although figures for the total amounts of Boeing subcontracting during World War II were no longer possible to segregate, some information is available for postwar years. *Exhibit 1* shows a 1948 estimate of the portion of \$422,000,000 worth of Air Force business which Boeing expected to share with subcontractors. As is shown, Boeing expected to spend about 34.2 per cent of the funds, or \$145,000,000, for subcontract items for the several planes listed.

As shown in *Exhibit 2*, by 1950 the proportion of Boeing income from the Air Force spent with subcontractors had increased to approximately 38.7 per cent. *Exhibit 3* indicates the portions of the three major aircraft produced by the Boeing Company in 1950, B-47, B-50, C-97 planes, which were procured from subcontractors. By 1951 the proportion of Boeing income spent with subcontractors had almost reached the peak World War II level, although still comparatively low in total volume.

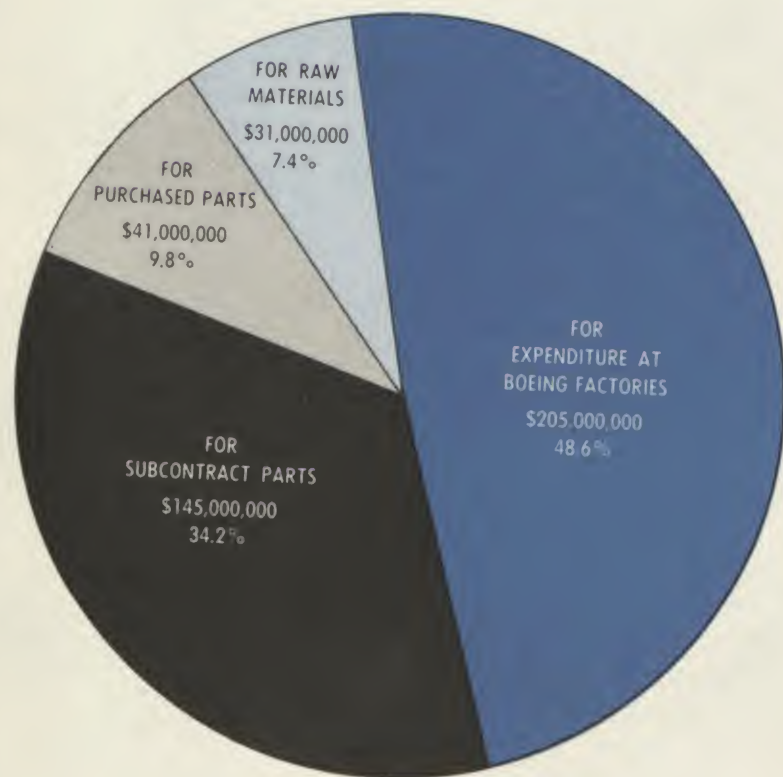
boeing subcontracting in the pacific northwest

Other things being equal, Pacific Northwest manufacturers enjoy an important advantage over manufacturers located elsewhere in the solicitation of Boeing work. Their location makes them very desirable sources from Boeing's point of view. It is the purpose of this study to examine in detail the characteristics of Boeing subcontracting activities in the Northwest area and the experience which Northwest subcontractors have had with Boeing work.

¹This was pointed out by a Company statement in the Boeing Magazine of April, 1951, as follows: "Measured by World War II standards, the volume of subcontracting is relatively low. On the basis of percentage, however, it is already approaching that of the war."

EXHIBIT 1

Estimated Distribution of Air Force Funds Received by the Boeing Airplane Company as of September 15, 1949*

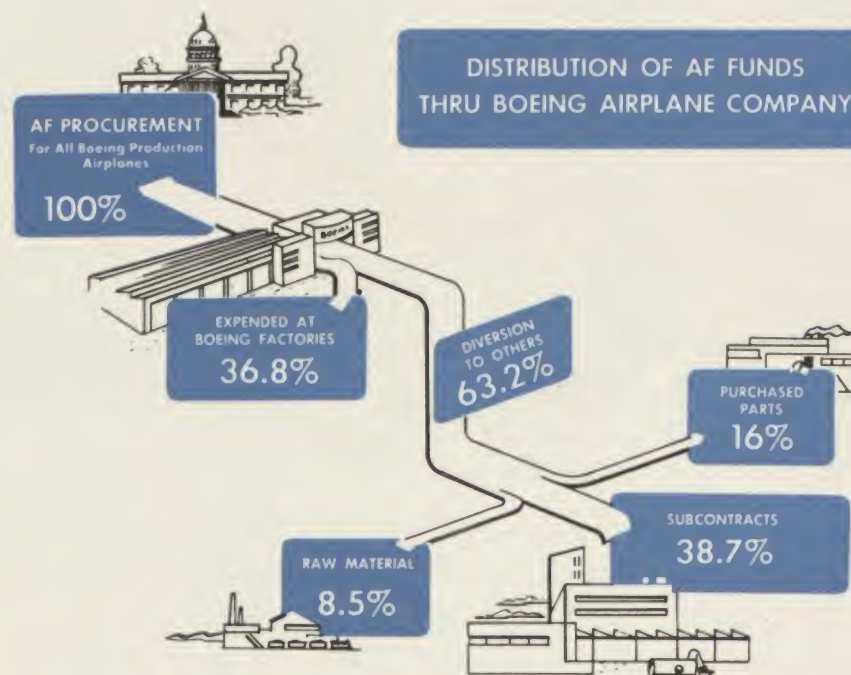


*Includes programs for:

- 82 B-50 planes and spares
- 132 B-50 planes and spares
- 27 C-97a planes and spares
- 54 B-47 planes and spares
- 30 B-54 planes and spares

EXHIBIT 2

Proportion of Boeing Air Force Income Spent with Subcontractors 1950*



ABOVE—Chart shows extent to which subcontractors, suppliers participate in Boeing work.

*Annual Report, Boeing Airplane Company, 1950

EXHIBIT 3

Proportions of Selected Military Aircraft Procured from Subcontractors

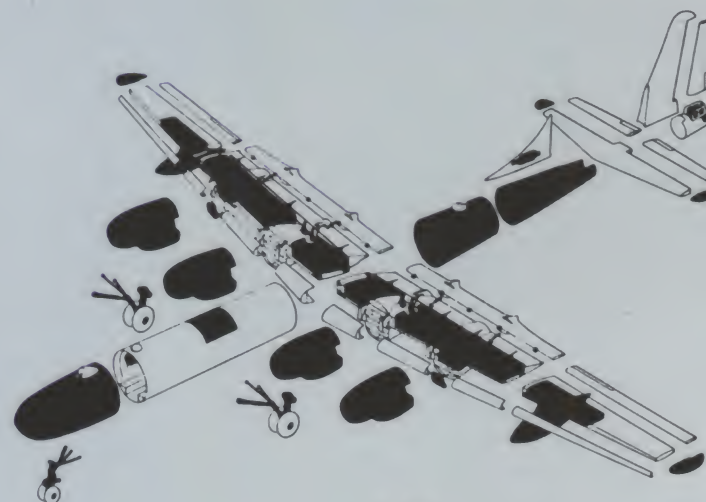


B-47

The blacked out sections of the
three planes shown were pro-
cured from subcontractors.



C-97



B-50

definition of subcontracting

Since *subcontracting* is a word which has been given many different meanings, the term should be defined as it will be used in this study. The general term, subcontracting, frequently refers to the practice on the part of a given manufacturing concern of looking to other firms to furnish some portion of the parts or subassemblies necessary to the final completion of its product. In the broadest sense, therefore, any purchase order may be considered a subcontract, and the term is so used in many instances. However, subcontracting, as the term is used by Boeing procurement officials, has a more restricted meaning. Suppliers of parts used in the manufacture of aircraft are grouped into two classes. The first class is composed of those firms which specialize in the production of such items as electronic instruments, fuel gauges, rivets, and cotter keys. Parts or assemblies procured from these firms are called purchased parts or purchased equipment and the firms are called suppliers. Items procured under these circumstances might be called standard parts available to a wide variety of manufacturers. Producers of these parts are generally specialists in their field with whom it would be difficult or unnecessary for Boeing to compete.

The second class of parts or subassemblies which Boeing procures from outside sources is composed of those items which Boeing shops are well equipped to handle and are accustomed to making. The producers of these parts are called subcontractors in Boeing purchasing terminology. It is with the firms that manufacture these parts that this study is concerned.

Important differences exist between these two classifications. In the first place, as mentioned previously, purchased parts are, in many cases, standard items which Boeing never intends to produce in its own shops. On the other hand, subcontracted parts are items of Boeing detail design and are peculiar to its own requirements.

A second important distinction may be made between the two classifications by the way in which suppliers and subcontractors are utilized. The volume of business placed with suppliers varies directly with the ebb and flow of plane production at Boeing. On the other hand, the volume of business placed with subcontractors depends not only on the volume of plane production, but also on many other variables. As will be discussed later in greater detail, a decision to subcontract or not to subcontract depends upon many circumstances, among which are manpower problems at the Seattle-Renton plants, shop load conditions, scheduling requirements, and occasionally, cost.

A third distinction between the two classifications may also be drawn. While this distinction is not so clear as the previous ones, it may be said that decisions to subcontract are made for economic reasons, while decisions to purchase from suppliers are largely technical in nature.



Renton Plant

Although at any given time the distinction between these two categories is fairly clear, certain items may shift from one classification to another. In the 1930's, landing gear assemblies were produced within Boeing plants. During World War II, landing gear assemblies were procured entirely from outside producers, and they are now considered purchased parts. A member of the purchasing department illustrated this when he stated, *the production of landing gear assemblies is a 'lost art' around here.*

This study has been confined to subcontracting since it is only in this classification that Pacific Northwest manufacturers may be found in any numbers. Virtually no suppliers of purchased parts or equipment such as jet engines, tires, or automatic pilots, are located in the Northwest area. It is only in subcontracting that Pacific Northwest manufacturers have been active in performing work for the Boeing Company.

B-29 Landing Gear



boeing reasons for utilizing subcontractors

Of central importance to the present study is the policy which is, and has been, followed by the Boeing Company in determining under what circumstances it will subcontract a portion of its work. Because this policy plays a major role in many of the areas under examination and because frequent reference will be made to it, a discussion should be presented early in the report.

As indicated previously, subcontracts are used by the management of the Seattle-Renton plants for the procurement of special parts or subassemblies of Boeing design. In general, Boeing shops and personnel are well equipped to handle subcontract items. The question immediately arises, then, as to why decisions are ever made to subcontract. Subcontractors may be called upon in any of the following circumstances:

- I.** Although Boeing possesses an adequate, modern machine shop, plant management feels that since machine shop facilities are readily available from outside sources, internal shop facilities need not be large enough to handle the needs of maximum production. Outside sources are therefore sought in order to minimize Boeing investment in plant and equipment insofar as is practicable. In actual practice, shop facilities are reserved almost exclusively for developmental or experimental work. *Production* machine work is procured from outside sources. Approximately 90% of the Company's machining requirements are procured from subcontractors.

2. Frequently over-all plant production schedules may temporarily call for greater capacity in one or more departments than is actually possessed. Subcontracting is usually undertaken in these cases in preference to increasing the capacity of the departments.
3. During periods of especially heavy demand for airplane production, such as World War II, the total capacity of the Seattle-Renton plants is inadequate to meet the demand even if operated on a twenty-four hour basis. Under such conditions, increased production can most readily be obtained by calling upon subcontractors.
4. Very infrequently, work will be subcontracted even though plant capacity is available if plant officials feel that a subcontractor has the special facilities to furnish the part at a lower cost than is possible within the plant.

As can be seen, Boeing officials feel subcontracting is a valuable supplement to their plant capacity and subcontractors are utilized as frequently as conditions warrant.¹

criteria for selection of subcontractors

While the vast majority of Boeing subcontracts are let on a competitive bid basis, bidding opportunities are not

¹To a considerable extent Boeing subcontracting policy is influenced by the policy of the Air Force to broaden the base for industrial procurement by encouraging the maximum amount of subcontracting on the part of their prime contractors consistent with the demands placed upon the prime.

ordinarily available to a firm until it has been approved by the Boeing purchasing department.¹ Firms which desire to make bids on Boeing work must first be approved by the procurement department. Boeing procurement officials use several criteria in the determination of which potential subcontractors are to be placed on the bidding list. In general, the criteria used in determining whether or not a particular firm will be invited to bid on Boeing work is as follows:

I. The firm must possess the machinery and equipment to perform the required operations. Work is never placed

¹Boeing subcontract agreements with outside sources for the production of parts for aircraft assemblies are of two kinds, fixed price contracts and "time and materials" contracts. The first type of contract is distinguished by the fact that it calls for the delivery of a definite number of particular parts on a given delivery date or series of delivery dates, for a fixed sum of money. Over 99% of all contracts placed by Boeing are of this nature. These contracts are customarily solicited and placed on the basis of competitive bids. Notice of the availability of such work is given to all firms deemed capable of performing the operations required and who have indicated their desire to make such bids.

In some cases, however, fixed price bids are impractical. In some of these cases, it is desirable to start work on given parts when the total delivery number is unknown, delivery schedules cannot be definitely specified, or for a number of other reasons. Under such circumstances, Boeing, with the permission of the Air Force, can place work in outside firms on a so-called "time and materials" basis. Under this arrangement, work is performed and paid for on the basis of labor hours worked and materials utilized. The rate paid per labor hour includes overhead charges. This work is normally placed with firms which have done work for Boeing previously and are known to be efficient producers. Even so, charges are carefully audited by both the Air Force and Boeing officials. In the case of manufacturers with whom "time and materials" contracts are placed rather continuously, Air Force and Boeing personnel every three months pick contracts at random and carefully audit all charges.

through *brokers* or other individuals who act for others or intend to lease plants or sub-subcontract to others.

2. The firm must be financially sound in the sense that it has or can prove it can obtain the necessary capital to handle the financial demands upon it created by the Boeing contract.
3. Management must be competent and possess the necessary production management skills to handle the complex requirements of aircraft work.
4. Some emphasis is also given to the service rendered the Boeing Company on previous contracts, if any. Procurement officials naturally give some weight to the fact that some firms have already proven themselves especially cooperative in meeting the needs of the Company by their readiness to adjust their schedules to design alterations, Boeing plant schedule changes, or other unexpected contingencies.

The reasons why potential subcontractors are chosen with the utmost care is readily apparent. A failure on the part of a subcontractor to meet a scheduled delivery date with acceptable work may not only stop assembly operations at the Boeing plant itself, but may also jeopardize the promised delivery of equipment vital to Air Force operations.

The Boeing procurement department maintains a team of specialists whose job it is to visit the plants of firms wishing to bid on Boeing work in order to ascertain whether they may be placed on bidding lists. Such a practice

works not only to the benefit of the Boeing Company but also for the benefit of the potential subcontractor. In this way bid requests are routed to those firms which are known to be capable of doing the work. This minimizes the submission of bids by firms which do not have the facilities to perform it economically.

the study procedure

At meetings of the Business Executives' Research Committee at which the purpose and objectives of the research study were established, it was determined that the information necessary to the study could best be obtained by interviews with officials of the firms performing subcontract work for the Boeing Airplane Company during the period under consideration. At the request of the Committee, procurement officials of the Seattle-Renton plants of the Boeing Company furnished a list of Pacific Northwest World War II subcontractors. This list supplied the basis for interview selection.

A preliminary interview guide was developed and tested on representative firms. Results of these interviews were then discussed at Research Committee meetings and a standard interview guide was established for use in subcontractor interviews.

Letters were then sent to the subcontractors by both the Bureau of Business Research and the Boeing Airplane Company informing them of the study and its objectives. Interviews were sought and obtained with the

subcontractors by Research Committee members. During the course of the period over which the interviews were conducted, regular meetings were held by the Committee at which completed interviews were discussed and analyzed.

When the interviews were completed, the results were summarized and tabulated, and further discussed at Research Committee meetings. This report is the result of the Committee's research and discussion program and represents the viewpoints of the members on the significance and implication of the Boeing Airplane Company's World War II subcontracting practices to the Pacific Northwest. Of course, not all members of the Research Committee were in uniform agreement on all issues and conclusions. Nevertheless, the report substantially represents the consensus among Committee members.



BOEING World War II Subcontracting in the Pacific Northwest

number of pacific northwest subcontractors

The Research Committee desired to interview all the Pacific Northwest manufacturers which had done work for the Boeing Airplane Company during the World War II period. The names of 67 Northwest manufacturers were listed by Boeing officials as having been subcontractors during the period from 1941 to 1945. Preliminary investigation revealed that 19 of these firms were no longer in business. In each of the 19 cases, it was found that very little work had been done for Boeing. In the case of many of the firms, so little work had been done for Boeing that their names could not even be recalled by procurement officials responsible for local subcontracting. For those which could be traced, it was discovered that a substantial number were small *one-man* businesses which had been discontinued with the death of the owner.

These 19 firms comprise about 29 per cent of the firms originally listed. This figure cannot be readily compared with standard business mortality figures because of the special nature of the group of firms involved. The only comparison which is probably feasible is the comparison with the mortality experience of the 69 Wichita, Kansas,

World War II aircraft subcontractors mentioned earlier. In the Wichita study it was discovered that 27 or about 40 per cent of the firms were no longer in existence by 1950. The mortality of Seattle subcontractors is therefore slightly less than that for Wichita subcontractors.

An additional five firms were dropped from the interview list because they had done such a small amount of work for the Boeing Company during the four year period. In no case did any of the firms so excluded do more than \$3,000 worth of business for Boeing during the war period.

In addition, Committee members were unable to interview seven other firms for a variety of reasons. In some instances, the ownership of the business had changed since the period under study and the present owners had no information on the firm's wartime experience with Boeing. In one case, no interview could be arranged because officials with the requisite knowledge were not in the Northwest area during the interview period.

Interviews were sought and obtained with the remaining 36 firms, and it is the results of these interviews that form the basis for this report. In almost all instances the interviewers found that the officials interviewed were

glad to cooperate and willing to give several hours of their time to the interviews. Where information could not be obtained it was, in most cases, because records no longer existed or officials could not remember the requested data, and not because of their reluctance to give the required information.

location of northwest subcontractors

Boeing's subcontracting activities in the Northwest have been virtually confined to the Seattle area. Of the original list of 67 wartime subcontractors, only six were located more than 40 miles away from Seattle. Four were in Portland, Oregon; one in Spokane, Washington; and one in Olympia, Washington. Of the remaining 61 firms, the vast majority were located in the immediate Seattle area, only four being as much as 30 miles away. This circumstance is even more true of the postwar period. Only one of Boeing's postwar subcontractors in the Northwest area is located outside the immediate Seattle area.

classification of northwest subcontractors by industry

Exhibit 4 indicates the activities in which the subcontractors were engaged during the period immediately

preceding the start of World War II. As is shown, the heaviest concentration of subcontractors was in metal stamping and jobbing machine work. The remaining firms were engaged in a wide variety of activities such as the production of rubber goods, equipment and ma-

chinery, apparel products, furniture, trucks and trailers, miscellaneous wood products, and electrical signs and display equipment. Two firms were engaged in the sole manufacture of aircraft parts, both of them doing work for Boeing.

EXHIBIT 4

Classification of Boeing World War II Pacific Northwest Subcontractors by Industry Represented

INDUSTRY	NUMBER OF FIRMS
Metal stamping and jobbing machine work	10
Industrial machinery manufacture	4
Furniture and wood products manufacture	3
Truck and trailer manufacture	2
Repair and rebuilding of electrical equipment	2
Aircraft parts manufacture	2
Plastics manufacture	2
Ornamental metal work	2
Sheet metal work	1
Apparel manufacture	1
Oil burner manufacture	1
Mechanical stoker manufacture	1
Mechanical power transmission equipment manufacture	1
Sleeping bag manufacture	1
Can manufacture	1
Rubber products manufacture	1
Electrical signs and display equipment-manufacture and repair	1
TOTAL	36

classification of northwest subcontractors by type of work done for boeing

Exhibit 5 shows another way in which Boeing subcontractors can be classified by the type of work done for Boeing during the wartime period. It can be seen that only a small number of firms, about 16 per cent of those interviewed, were engaged in the manufacture of major aircraft component parts, such as noses and wing spars, for the Boeing Company during the war. This proportion is even less if the total number of subcontractors in the area, approximately 67, is considered, as it is known that none of the firms no longer in business produced major assemblies for Boeing.

Seven firms produced small airborne assemblies such as bombardier cabinets and panel assemblies. The largest number of firms, 13, produced small parts such as tools, dies, jigs and fixtures to be used in the Boeing plants for the construction of airborne parts. Boeing customarily subcontracts the manufacture of small tools, dies and jigs, and a substantial portion of these items are obtained from small local shops equipped to do the work. These firms are also well equipped to produce such small parts required in plane assembly as pins, bolts, gears and spacers. When World War II aircraft production demands required thousands of these small items, many of the small shops accustomed to producing Boeing tooling requirements were called upon to produce them.

In general, it may be said that for the most part the Boeing Company procured the major portion of its larger subcontract parts from sources located outside the Northwest area, and looked to Pacific Northwest sources for the procurement of small parts, production tooling, and small assemblies.

size of northwest subcontractors

It might be expected that the majority of Boeing wartime subcontractors would be small businesses for two major reasons:

- 1.** the Northwest area is primarily one of small business;
- 2.** small firms are more likely to act as subcontractors than as prime contractors.

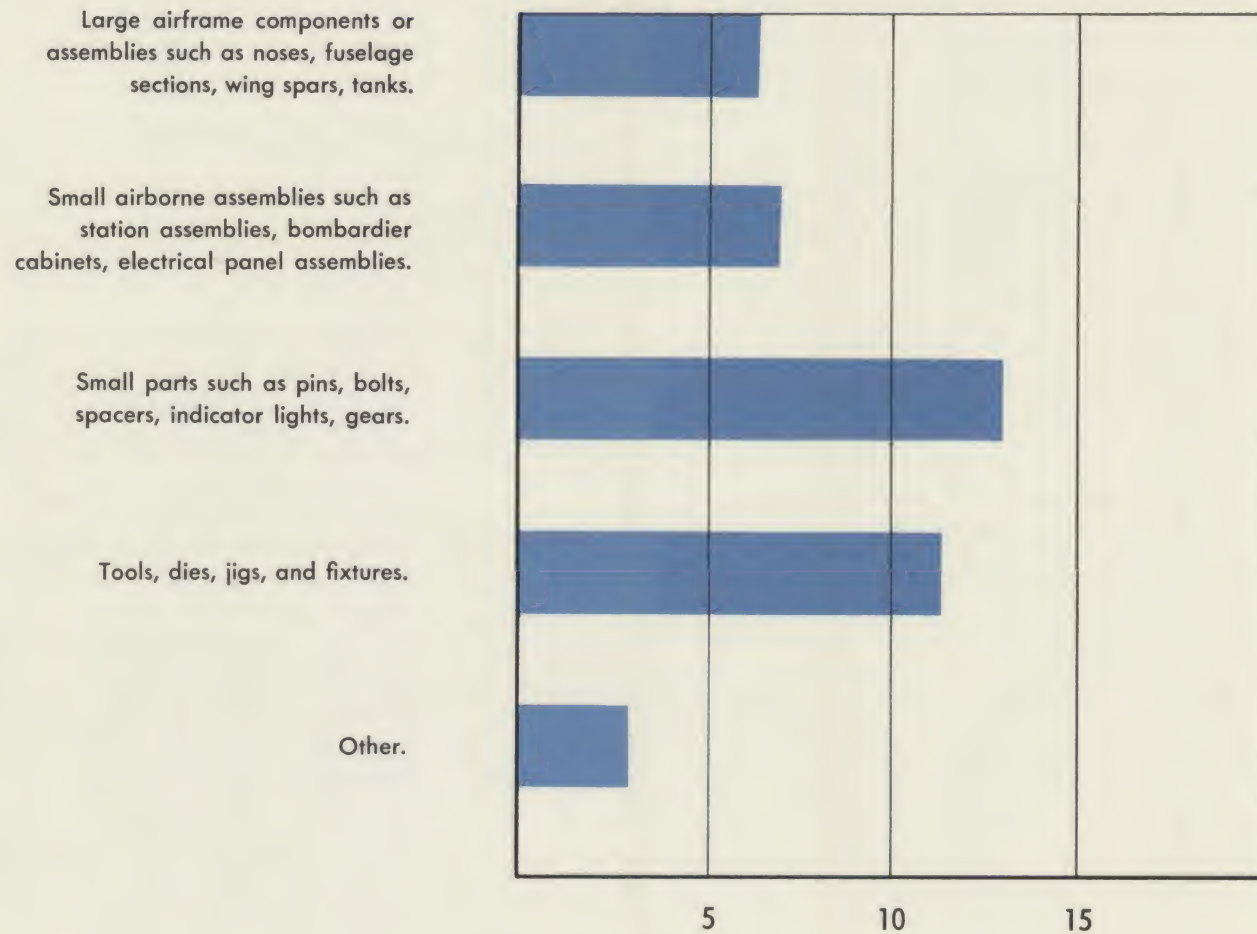
That this is, in fact, the case is shown by *Exhibit 6*. Volume of employment was chosen for the purpose of measuring the size of subcontractors because employment figures were more readily available than sales, volume of investment, assets, or other data frequently used.¹ In many cases the firms were individual proprietorships where financial records covering the war period were no longer in existence.

¹Volume of employment is appropriate since it corresponds somewhat roughly with value added, a measure of particular significance when the importance of a firm to a community is under examination.

EXHIBIT 5

Subcontract Items Supplied to Boeing by Pacific Northwest Subcontractors

ITEMS SUPPLIED*



*Some firms interviewed supplied more than one item.

NUMBER OF NORTHWEST FIRMS SUPPLYING SUCH ITEMS

As shown in *Exhibit 6*, 20 of the 30 firms for which data were available employed less than 50 people in 1940. Thirteen of these firms employed less than 25 people, many of them having only two to nine employees. Characteristically, the firms were each owned and operated by one individual who took responsibility for the performance of all supervisory functions. While there were six firms employing over 200 persons in the subcontractor group, only one could be described as being large. With the exception of the fact that many of the machine shops were small, no particular size pattern could be discerned for the industry classifications given in *Exhibit 4*.

amount of prewar subcontracting experience

Although many of Boeing's Northwest contractors were metal working plants with some prewar experience in subcontracting, a substantial portion of the firms had little or no military subcontracting experience prior to 1941. As shown in *Exhibit 7*, about 33 per cent of Boeing's World War II subcontractors had extensive prewar subcontracting experience. However, over half of the firms, approximately 53 per cent, either had no experience in doing subcontract work or were created in the early stages of the defense program to perform military work.

The majority of the firms with no prewar experience in subcontracting either manufactured and sold products of their own or were in service industries engaged in the repair and rebuilding of equipment.

Of the 36 subcontractors interviewed, only nine had done work for Boeing prior to the war. Before 1941 the volume of plane production at Boeing had been very low and subcontract opportunities consequently few. It was only with the advent of the war that large scale subcontracting was done by the Boeing Company. Many Northwest firms were not aware of the opportunity to act as subcontractors for the Boeing Company during the early stages of World War II defense production. Very few firms in the Northwest had had any experience in producing aircraft parts and in many instances were uncertain of their ability to fabricate them. While most of the remaining 27 firms sought subcontract work from Boeing, in some cases the initial contact with the firm was made by Boeing procurement officials. During the early stages of wartime plane production, Boeing purchasing agents took parts and went from door to door seeking firms with the ability and capacity to manufacture them.

EXHIBIT 6

Size of Boeing World War II Pacific Northwest Subcontractors Measured by Volume of Employment

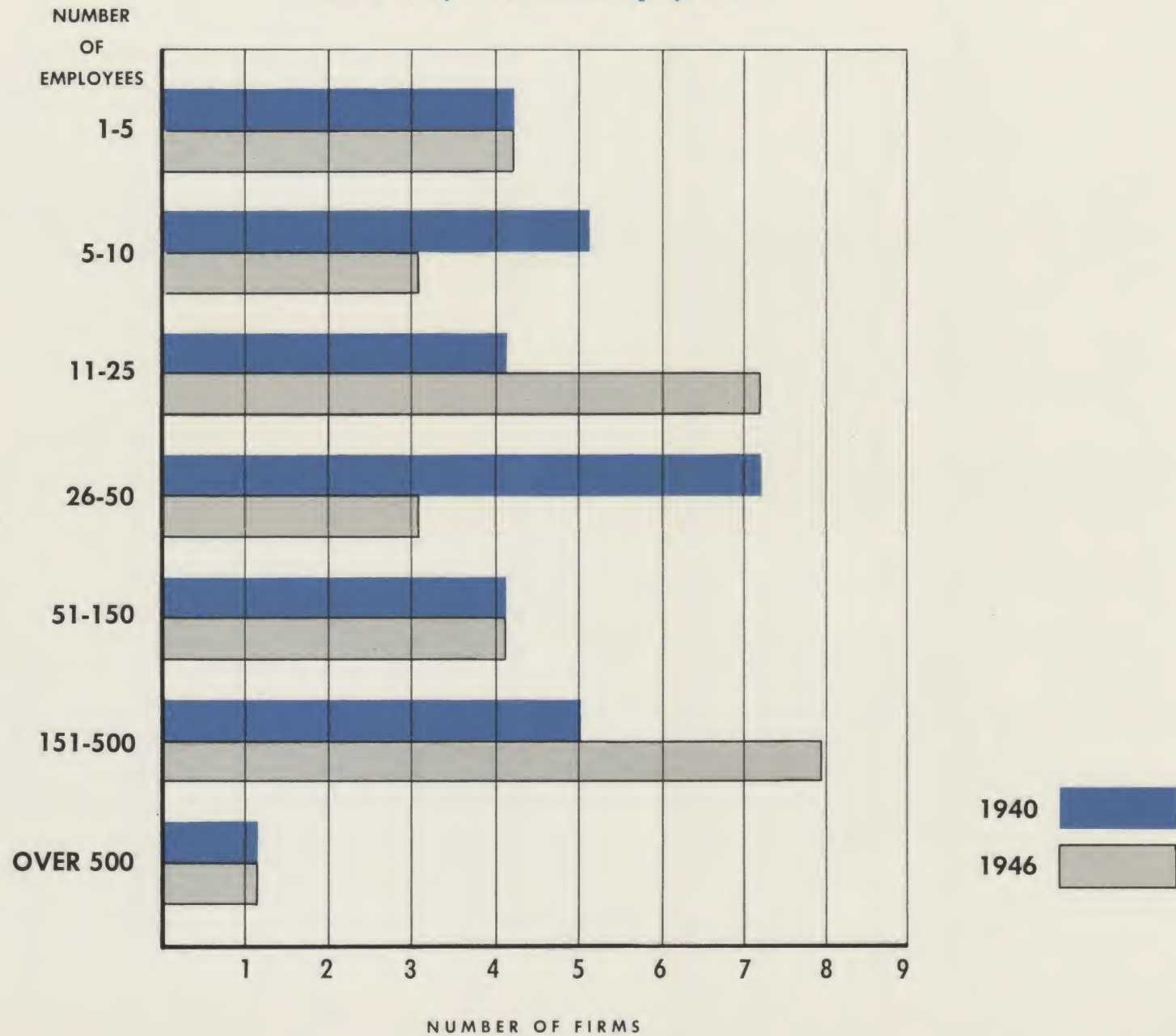
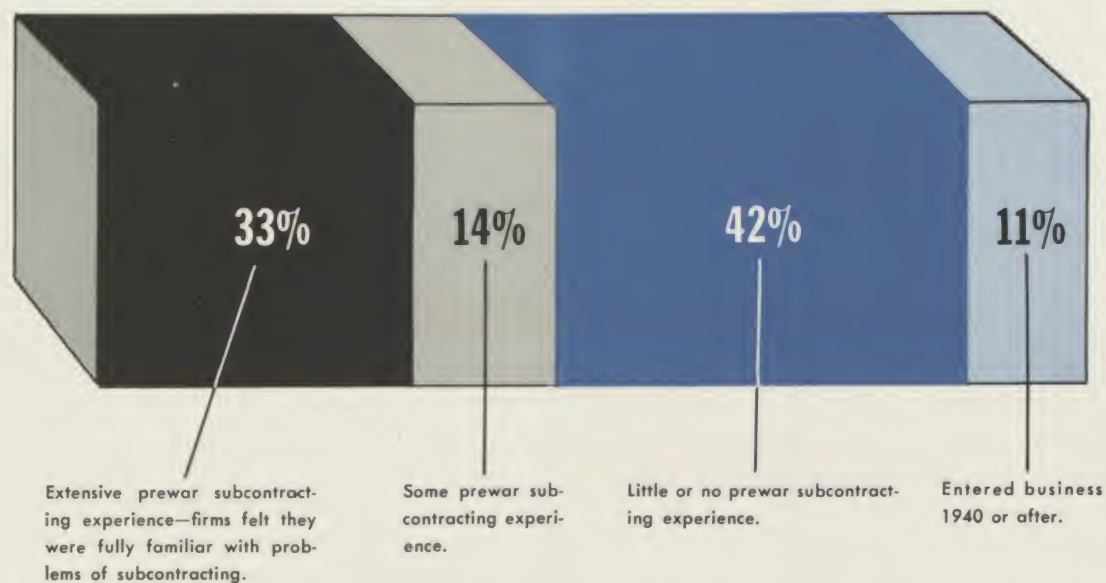


EXHIBIT 7

Extent of Prewar Subcontracting Experience of Boeing World War II Subcontractors



problems encountered by subcontractors at the beginning of world war II

During the war the Boeing Company sought to obtain a substantial portion of its metal working requirements from subcontractors. In the Pacific Northwest area other military prime contractors such as the shipyards and military agencies such as the Naval Yard at Bremerton, Washington, also sought to utilize the metal working capacity of Northwest firms. Many of Boeing's subcontractors such as machine shops and others producing metal products had a choice of working for several prime contractors or defense agencies. For them the transition from a peacetime economy to that of a wartime one was relatively simple. In most instances such firms merely stopped producing prewar products and began producing military products with no perceptible alteration in their manufacturing activities.

However, for many other Northwest firms the problem was not so simple. Some of them produced products for

which there was some defense need but where the need was not critical enough to insure their operating at any level close to that which they had enjoyed during the prewar period. A good example of such firms was the furniture manufacturing industry in the area. Although there was some demand for furniture for defense housing and offices, priorities could not be obtained to insure that their capacity could be utilized at any normal prewar level. These firms actively sought military work not related to their prewar product line but within their manufacturing capacity in order to make a contribution to the war effort and to utilize idle capacity. For these firms, Boeing work — although not essential to their survival — nevertheless helped them to maintain their volume of operations.

For still other Northwest firms the problem of staying in business during the war was even more difficult. Many of them were unable to get any kind of a priority to obtain materials to continue manufacture of their peacetime product. After the Seattle area was declared a critical

labor shortage area early in the war period, several of them were specifically directed to cease the manufacture of their regular product line. For these firms the choice was either to cease operations altogether or perform either aircraft or maritime work. It is obvious, therefore, that for these firms Boeing work not only offered an opportunity to contribute to the war effort and to maintain skilled work forces, but also enabled them to maintain their existence.

While it is extremely difficult to make any estimate as to what extent Boeing work enabled Northwest firms to continue in business, it probably can be said that about one-third of the firms interviewed had prewar products which were not essential to the war effort and would not have been able to remain in business if war work had not been available to them from some source.

EXHIBIT 8

Wartime Increases in Boeing World War II Subcontractor Employment

GROUP	NUMBER OF FIRMS	AVERAGE NUMBER OF EMPLOYEES		AVERAGE INCREASE (PER CENT)
		1940	MAXIMUM EMPLOYMENT WARTIME YEAR	
1. (0-50 employees)	20	19	81	326
2. (100-150 employees)	4	126	1425	1031
3. (200-500 employees)	5	291	409	41
4. (Over 500 employees)	1	820	4620	465

wartime increase in subcontractor employment

Volume of employment was again chosen to reflect the increase in size of subcontractors during the wartime period. Such increases in size are illustrated by *Exhibit 8*. For the purpose of this demonstration, the firms which were in existence during 1940 were grouped arbitrarily into four classes. Twenty of the firms for which data were available had between 0 and 50 employees. A second group of four employed between 100 and 150 persons. A third group of five firms had between 200 and 500 employees. The remaining firm employed slightly over 800 persons.

Average employment for the first group increased from 19 employees in 1940 to an average of 81 employees during the period in which maximum wartime employment and output was experienced. It was within group 2, however, that very large increases occurred. This group had an average employment in 1940 of 126 people. Their wartime employment increased to an average of slightly over 1400, an increase of about 1031 per cent. A much more moderate increase was experienced by those firms in group 3 employing from 200 to 500 people in 1940. For this group the increase in employment was only 41 per cent. No particular reason could be ascertained for

such a difference as existed between groups 2 and 3 other than that the former were unusually successful in obtaining military contracts.

wartime operating problems of subcontractors-management

As has been shown in a previous section, Boeing Northwest subcontractors were, in many cases, essentially small *one-man* operated businesses. While these firms experienced substantial increases in size during the period from 1941 to 1945, the expansion was not generally accompanied by an increase in the size of the management structure. In most cases, the officials of these small firms felt that they were able to handle the needs of war production without additional high-level supervisory assistance. In some instances these executives handled the supervision of production activities, procurement of business, purchasing, and accounting. It was evident that, during the early phases of their wartime expansion at least, inadequate accounting records were kept. While some firms recognized this need early, for others such recognition came, if at all, only in the closing phases of wartime production. Many of the subcontractors spoke proudly of the long hours which they had spent at their plants during the wartime period.

While a considerable portion of this time spent represented a necessary contribution to the war effort, it is almost certain that in many instances it was a case of one individual attempting to do too many things at the same time. For the larger Boeing subcontractors, the picture was very different. In most cases the need for additional supervisory help was clear and the necessary additions were made. These additions did not represent significant changes in the type or character of the supervisory organization but generally represented simple increases in the number of supervisory personnel employed to handle the increased volume of output.

wartime operating problems of subcontractors-plant and equipment

A considerable portion of the firms interviewed during the course of the study were able to handle wartime production requirements without significant additions to either physical plant or equipment. Fifteen of the 36 firms interviewed obtained required output increases by utilizing idle equipment and by operating on a multiple shift basis.

Seventeen of the firms interviewed reported substantial additions to physical facilities during the wartime period.

These additions ranged from the purchase of a few pieces of equipment to the erection of new buildings. Since many of the firms interviewed performed work for other prime contractors, as will be indicated later, it is not clear what proportion of the necessary additions to physical facilities was due primarily to work performed for the Boeing Company. It is, however, very probable that had the firms done work only for Boeing, very few of them would have found it necessary to make substantial additions to their plant and equipment.

wartime operating problems of subcontractors-changes in financial requirements

In an earlier section it was indicated that a substantial portion of Boeing's Northwest subcontractors were small firms, many of them being owned and managed by a single individual. Information was collected during the study on the financial arrangements made by subcontractors in order to handle the generally increased output and employment of the war period. In 22 of the 36 firms interviewed no outside financial help was utilized by the subcontractor. In these instances the owner-manager was able to finance the requirements of war production without recourse to banks or government lending agencies. In general, the firms which did not utilize outside

sources of funds were small establishments and in most cases no significant increases in capital investment were made.

There seemed to be several reasons why outside sources of funds were not utilized by the smaller subcontractors. These may be summarized as follows:

- 1. Prompt payment for finished items by the Boeing Company.*
- 2. Materials for many parts were furnished by Boeing.*
- 3. As prewar inventories were liquidated, funds were made available for war production. Greater turnover in wartime products enabled a larger volume of business to be done with the same capital.*
- 4. Reinvestment of profits.*
- 5. Ability of many subcontractors to make substantial increases in output without commensurate increases in investment by operating their plants on a multiple shift basis.*

- 6. Extreme reluctance of subcontractors to borrow unless absolutely necessary.*

Of course, the participation of many of the larger subcontractors in war production called for substantial increases in their wartime requirements. The majority of these firms utilized ordinary bank loans to handle their needs. In one instance financial requirements were met by the sale of stock. The facilities of government lending agencies were utilized by only two of the subcontractors interviewed. These two firms obtained loans from the Reconstruction Finance Corporation.

During the course of the study, wartime credit policies were discussed with officials of leading Seattle banks. Discussions with them indicated that rather liberal lending policies had been followed during the wartime period in the issuance of loans to firms with defense contracts.¹

¹Early in the defense program several Seattle banks created a joint credit pool for the purpose of granting loans to marginal credit risks. Although the fund remained active for a considerable period of time only two small loans were made. Seattle bank officials stated that credit requests had been handled almost entirely through regular banking channels.

*amount of help furnished by boeing to its
northwest subcontractors*

In other studies where wartime subcontracting has been examined, frequent reference has been made to the amount of help which the subcontractor needed from the prime in order to furnish a satisfactory product.¹ In some instances prime contractors have furnished teams of experts to their subs to remain on loan until the subcontractor had enough experience and know-how to supply satisfactory parts or subassemblies to the prime. The Boeing Airplane Company is prepared to, and often does, supply various amounts of technical assistance to its subcontractors. During the course of the present study, subcontractors were asked to discuss the amount of help which they had received from Boeing during the war period. While 20 of the subcontractors reported various kinds of assistance from Boeing, 16 stated that they had received no help from Boeing beyond the furnishing of specifications. Of the 20 which reported assistance from Boeing, about half had received help in obtaining materials beyond the furnishing of the necessary priority, slightly over half had received technical advice and assistance, and four had received equipment.

¹See Problems of Accelerating Aircraft Production During World War II. Division of research, Graduate school of Business Administration, Harvard University. 1946. p. 67-8.

Examination of the comments of those subcontractors which had not received help from Boeing revealed good reasons why help was unnecessary. Many of them were small machine shops making tools and dies for the Boeing Company. This was well within their accustomed line of work and it is not surprising that no assistance was required. In other instances, the firms were manufacturers of wood products where the products supplied Boeing were such items as compartment doors and bombardier cabinets made of plywood and of rather simple design. Here, too, the parts supplied were well within the manufacturer's prewar experience and knowledge. It was only in those cases where the manufacturer supplied Boeing with aluminum or steel parts or complex subassemblies that technical advice and help from Boeing was required.

It is undoubtedly true, however, that many problems which arose during the war period between subcontractors and the Boeing Company were settled by phone calls or by quick visits by Boeing representatives which were not recalled by subcontractors. *This is one of the many advantages enjoyed by subcontractors located near the prime contractor. Problems can be mutually solved quickly and readily which might create considerable difficulty if hundreds and even thousands of miles separate the two.*

In all instances the subcontractors reported that Boeing officials were ever ready to supply all possible help. The close proximity of the subcontractors to Boeing made it possible for Boeing officials to have rather close personal knowledge of the subcontractor's facility and problems. Such close personal knowledge aided the solution of mutual problems to a notable extent.

*extent to which boeing subcontractors
in the northwest served other prime
contractors or defense agencies*

Employment data for the period 1940 through 1946 were available for 24 of the 36 firms interviewed during the study. *Exhibit 9* indicates the proportion of subcontractor employees occupied on Boeing work during the three periods emphasized by the study. In 1940, an average of 26.7 per cent of the employees of firms employing less than 25 persons were busy with work for Boeing, while only 15.1 and 1.2 per cent of the employees of the medium size and largest firms were so occupied.

During the period of maximum wartime employment and output, Boeing Company required a substantial share of the employment of the firms employing less than

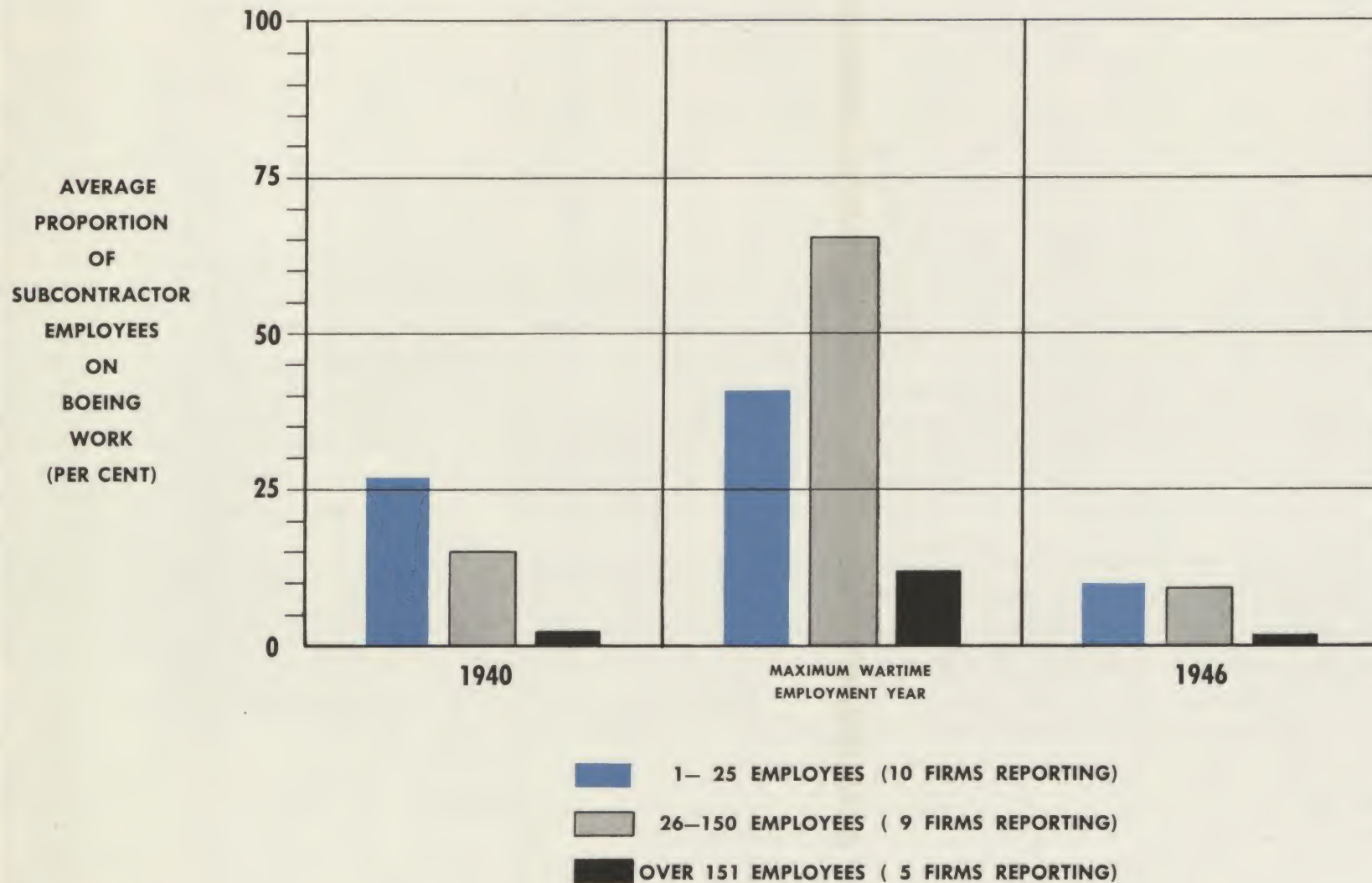
150 people, 36.7 per cent or over, but was responsible for only 11.1 per cent of the employment of the largest firms.

During 1946, the respective portions of employment of the small, medium and large firms accounted for by Boeing work were 8.0, 7.7, and .2 per cent. As the figures for the three periods clearly demonstrate, the subcontractors in the two smaller groups were much more dependent upon Boeing work than subcontractors in the group containing the largest firms.

Only eight of the 36 firms interviewed were occupied wholly with Boeing work during 1941-45. The capacity of the remaining firms was devoted to work for other prime contractors and defense agencies and to regular commercial work. A substantial proportion of them performed work for Puget Sound shipyards, the Maritime Commission, the Bremerton Navy Yard, and various departments of the Army. It can be seen from *Exhibit 9* that even during periods of maximum wartime employment, most of the subcontractors were doing the major proportion of their military work for defense agencies or prime contractors other than Boeing.

EXHIBIT 9

Proportion of Northwest Subcontractor Employees
on Boeing Work for Selected Years



*northwest firms which originated
as boeing subcontractors*

One of the major objectives of the study was to ascertain the number of Pacific Northwest firms which had come into existence as a result of Boeing subcontracting opportunities. It was known that some firms had been created specifically for the purpose of doing subcontracting work for Boeing. Their continued success during the postwar period had raised the question of how many firms had been able to get into business as a result of the availability of Boeing aircraft work. As was mentioned earlier, a study of 69 Wichita, Kansas, wartime aircraft subcontractors revealed that 40 of them had originated as *war babies*.

The study of Boeing subcontractors in the Northwest indicates, however, that in contrast to the Kansas study, very few firms originated as Boeing subcontractors. In only four instances could it be said that the firm had been organized for the purpose of wartime subcontracting. A fifth firm had production facilities elsewhere but had located a subsidiary in the Seattle area for the purpose of doing Boeing work. A sixth firm was organized to do subcontract work for Seattle shipyards and later

added some work for Boeing. Therefore, it might be said that about 16 per cent of the firms interviewed had been created for the purpose of performing aircraft or defense work in the Northwest area.

The reason so few firms had been able to get into business as a result of the possibility of Boeing work has already been explained in an earlier section. The procurement policy of Boeing Northwest plants was, and is, to purchase subcontract items from only those firms which already have available the necessary equipment and production time. Their policy, therefore, is one of dealing with established firms. Under these circumstances, it is not unusual that very few firms would be organized initially to serve as Boeing subcontractors.

Interviews with Boeing management have established that it is not the policy of the Company to encourage the development of new industrial capacity in the area if the capacity is for the *sole* purpose of performing subcontract work for Boeing. This policy has its roots in the knowledge that there is no way in which Company management can assure such subcontractors of any amount of consistent work.

preference of boeing subcontractors to act as prime contractors or as subcontractors

A majority of the 36 firms interviewed during the course of the study had acted as prime contractors as well as subcontractors for Boeing. All firms interviewed were cognizant of the opportunities for industrial firms to act as prime contractors for military procurement departments. In most cases, firm officials had given careful study to both types of opportunities for defense work. As might be anticipated, the smaller firms generally expressed a preference for subcontracting. The officials of such firms emphasized the difficulty and *red tape* involved in prime contracting. An official of one subcontractor expressed well the feelings of a good many when he said, "I prefer to have the Boeing Company analyze and 'break-down' government contract requirements and then send me work that I can do." He then stated, "In a way, Boeing is acting as a procurement agency for me."

By and large, officials of the larger firms interviewed either had no preference or were willing to do either type of work or preferred to act as a prime contractor if possible. Most of them felt that they had the facilities, technical knowledge and management experience to handle prime contracting. In such instances they felt that

they had greater freedom in choosing the type of work they wanted to do and had greater control over the end product than they would have acting as a subcontractor. Some officials stated that they would rather not be responsible to, or subject to the check of, other companies.

postwar reconversion of boeing subcontractors

One of the major objectives of the Committee study was to ascertain what effect wartime subcontracting operations for the Boeing Company had had on the postwar reconversion of its subcontractors. Sixty per cent of the subcontractors interviewed did no Boeing work in 1940. By 1946, 68 per cent of the firms were no longer doing any Boeing work. It is clear then, that for the majority of Boeing subcontractors, work for Boeing was confined almost wholly to the war period.

Of the 32 firms interviewed which had been in business prior to the war, virtually all returned as quickly as possible to their prewar product or service line. Twenty-four, or 75 per cent, of these firms made no postwar changes as a result of their wartime activities. For these firms wartime subcontracting served almost entirely as a method of filling the void left by their inability to manufacture their peacetime products during the war.

Eight of the firms, however, made significant alterations or improvements in their product line or type of work performed after the war period. Many of these changes came about as a result of the firm's wartime production. Although all firms reported that the experience gained on Boeing work was of value to them in terms of increasing their ability to do precision work, utilize improved production methods, maintain good accounting records, etc., in some cases such increases in technical knowledge were put to immediate use during the postwar period. For example, one firm was engaged in the manufacture of rubber soles and heels during the prewar years. During the war, this firm produced a wide variety of extruded rubber products for the Boeing Company. As a result of this experience in performing difficult operations with rubber, the firm was able successfully to enter the industrial rubber goods market.

In many cases, wartime production for the Boeing Company aided the firm by establishing it as a desirable source for parts procurement by the Boeing Company. These firms have been able, in recent years, to obtain a substantial volume of business from Boeing.

Virtually all of the firms found themselves in an im-

proved competitive position during the early years of the postwar period. *Exhibit 10* demonstrates changes in the volume of employment for the subcontractors interviewed between 1940 and 1946. Although these employment changes reflect to some extent the firms' participation in the general prosperity characteristic of 1946, they also offer evidence that the firms came out of the war in a better position than they had when they entered it.

In some instances Boeing wartime subcontractors were able to retain a substantial proportion of their wartime peak employments. As is shown in *Exhibit 11*, the five firms employing between 200 and 500 persons during 1940 were able to maintain 90 per cent of their peak wartime employment during 1946. In a previous section, it was pointed out that the four firms employing between 100 and 200 people during 1940 experienced a phenomenal increase in output and employment during the war years. These firms were not as successful in retaining their wartime employment as the establishments in the next higher class shown in *Exhibit 11*. Although these firms were still substantially larger in 1946 than they were in 1940, they were able to retain only 28 per cent of their wartime peak employment.

contract termination and renegotiation

During the course of the interviews with Boeing wartime subcontractors, information was obtained concerning their experiences with contract termination and renegotiation. All firms interviewed uniformly agreed that satisfactory contract termination settlements with Boeing had been arrived at promptly. Subcontractors generally understood quite well the basis upon which contracts had been terminated and felt that all legitimate charges had been met by Boeing.

However, subcontractors reported a somewhat different experience with regard to renegotiation of wartime profits. In general, the firms could be grouped rather distinctly into three classes:

1. Those not subject to renegotiation.
2. Those which felt renegotiation payments had been fair and reasonable.
3. Those which felt renegotiation payments had been unreasonable.

Fourteen of the 36 firms interviewed had been required to make renegotiation payments covering operations during one or more years.

About half of these firms, generally the larger ones, reported no adverse effects due to renegotiation. In al-

most every instance, the management had anticipated renegotiation, and had made provisions for its probable impact.

For the remaining smaller firms, however, it was evident that renegotiation had come as something of a surprise. The owners of these firms uniformly felt that renegotiation had had an unreasonable adverse impact on their wartime income. Various reasons were given for these feelings by subcontractors, but two were repeated with regularity. Many subcontractors stated that adequate allowances for depreciation of machinery and equipment had not been made. Several of them pointed out that they had operated their equipment 24 hours a day and that sufficient depreciation allowances to cover such consequent rapid depreciation was not allowed. It was also stated that although the renegotiation acts had specifically provided for the recognition of efficiency, that such had not been the case. There was a somewhat general feeling that proper recognition had not been given to increased efficiency, and that efficient subcontractors had emerged from renegotiation less well off than inefficient ones.¹

¹Some substantiation to these claims that efficiency was not properly recognized by renegotiation officials have been given by writers on this subject. See Miller, J. P. Pricing of Military Procurements, p. 181.

Some subcontractors also objected to the way in which their books were examined and renegotiation payments determined. They felt that such determinations had been made unilaterally, and that they did not have the legal staffs or knowledge to present their case adequately.

Regardless of whether or not renegotiation settlements were equitable, it is certain that renegotiation investigations caught them virtually unprepared. As one subcontractor put it, "If I had known then what I know now, I would have hired an accountant to take care of me to offset the auditors coming around to take care of the government." In no other phase of the study was the need for adequate accounting and financial control records so

clearly demonstrated. Firms with such control records were fully prepared for renegotiation and experienced no adverse effects, whereas firms without such records were caught virtually unprepared and renegotiation payments came as something of a shock. Although subcontractors felt strongly about the lack of proper recognition of efficiency, it was evident that in many cases proper accounting records upon which claims for increased efficiency could be based were not maintained.

Several firms felt so strongly about the impact of renegotiation upon them that they stated that they had established a policy of limiting their renegotiable business to a figure which would keep them below the minimum which would make them subject to renegotiation.

EXHIBIT 10

Employment Changes Between 1940 and 1946 for Boeing World War II Subcontractors

FIRM	EMPLOYMENT		PER CENT CHANGE
	1940	1946	
A	2	30	1400
B	3	5	67
C	4	3	- 25
D	4	5	25
E	9	10	11
F	10	15	50
G	10	8	- 20
H	10	10	0
I	12	15	25
J	18	25	39
K	20	2	- 90
L	27	30	11
M	30	75	150
N	30	45	50

FIRM	EMPLOYMENT		PER CENT CHANGE
	1940	1946	
O	30	25	- 16
P	35	130	272
Q	35	150	328
R	45	20	- 55
S	100	300	200
T	125	755	504
U	130	211	62
V	150	300	100
W	230	250	9
X	250	300	20
Y	275	441	60
Z	300	400	33
AA	400	450	13
BB	820	2810	243

EXHIBIT 11

Proportion of Wartime Maximum Employment of Boeing Northwest Subcontractors Retained in 1946

GROUP	NUMBER OF FIRMS	AVERAGE EMPLOYMENT		PER CENT MAXIMUM HELD '46
		MAXIMUM EMPLOYMENT WARTIME YEAR	1946	
1. (0-50 employees)	20	81	34	42
2. (100-200 employees)	4	1425	392	28
3. (200-500 employees)	5	409	370	90
4. (Over 500 employees)	1	4620	2310	61

CONCLUSION...

some generalizations on boeing subcontracting in the northwest

As a result of its study of the World War II subcontracting experience of the Boeing Company in the Pacific Northwest, the Research Committee arrived at a number of generalizations. *It cannot be too strongly emphasized that these generalizations apply only to the subcontracting activities of the Boeing Company, and not to its many other activities which also have great significance to the Northwest.*

Subcontracting is an integral and essential part of Boeing production policy and has been so for the past fourteen years. As has been shown, beginning with the early part of World War II, subcontractors have been actively utilized as sources for a substantial portion of the parts and subassemblies required for the construction of Boeing aircraft. Pacific Northwest manufacturers were first sought as subcontractors early in the war period and manufacturers in the East were sought as subcontract sources only after it was clear that the required part

could not be made in the Northwest.

However, despite the fact that Northwest manufacturers were first sought as subcontract sources, and that many Northwest manufacturers have served Boeing as subcontractors, the volume of Boeing subcontracting in the Northwest is not as large as has been generally supposed. Even during the height of World War II production, Boeing subcontractors were engaged primarily in work for other defense agencies. Although figures for the total amount of Boeing World War II expenditures on subcontract parts procured from Northwest manufacturers are not possible to obtain, some estimates can be made for the Korean emergency. By 1951, Boeing purchases of parts from Northwest subcontractors amounted to about \$2,000,000 annually.

Although this figure is substantially less than that reached during World War II, and although it cannot be compared readily with the total volume of subcontract purchases by Boeing from all parts of the United States, it is undoubtedly less than two per cent.

The third major generalization arrived at by the Committee was that Northwest subcontracting is generally done by Boeing only on military work, and that as a consequence, the volume of work placed in Northwest plants has fluctuated sharply over the past 15 years. While over 3,000 persons were employed by the Northwest subcontractors interviewed on Boeing work during their periods of peak wartime employment, by 1946 only 103 were so engaged. During the immediate postwar period the Boeing Company, as a matter of policy, confined its major subcontracting operations to firms within the aircraft industry. As stated in the *Boeing Magazine* of April, 1951,

Major subcontracting was retained largely within the aircraft industry and its immediate allies during the industry's 'lean' years after the war, as a matter of national policy. The program, as followed by Boeing, was to spread the military work to other aircraft firms, helping keep the industry alive so it would be ready for prompt expansion in an emergency such as today's.

In addition to doing the vast majority of its subcontracting with firms located in other parts of the United States, Boeing also procures a different class of aircraft parts from Northwest manufacturers than is procured from sources in other areas. As will be discussed in greater detail in the next section, the limited facilities of Northwest subcontractors and potential subcontractors have forced Boeing to procure major aircraft components from producers outside the local area. The facilities possessed by most Northwest manufacturers make them suitable sources of small parts and tooling requirements and they have been so used by the Boeing Company. This characteristic of Boeing purchasing activities is particularly true of the post World War II period.

A further circumstance encountered by the Committee during the course of its study was the lack of preparation of many small *one-man* operated firms for the problems created by their wartime work for the Boeing Company. Characteristically, most of these firms had very few employees at the start of the war. Although well equipped for their previous peacetime operations, the production of aircraft parts in substantial volume created many difficulties. In some cases, the operators of these firms found the complex requirements of aircraft work difficult to

understand and to meet. Far more serious, however, was the absence of adequate accounting and financial control records necessary for the increased volume of military business. In some cases, the need for such records was not recognized until after the war was over.¹ The problems of expansion were made even more difficult because they occurred under the pressure of wartime conditions when skilled manpower was considerably thinned by the demands of the war effort. However, it was generally felt by the Committee that, although there were some exceptions, both Boeing and its subcontractors approached their wartime relationship realistically, and that the subcontracting experience was generally satisfactory to both groups. Northwest firms made a substantial contribution to necessary Boeing expansion, while Boeing work enabled some subcontractors to hold workforces and organizations together and assisted others to do so, and gave all an opportunity to increase their experience and knowledge on new and different processing techniques. In many instances this new knowledge proved very useful to the firms in their postwar operations.

¹Not all small subcontractors experienced such difficulties. Many small firms were interviewed where the owners were perfectly aware of the problems involved and met them in an intelligent fashion.

One other aspect of Boeing's subcontracting operations in the Northwest remains to be considered. During the years following World War II Boeing, along with many other aircraft producers, had difficulty in keeping even what might be called a skeletal workforce busy in its own plants. As is shown in *Exhibit 12*, employment fell from approximately 44,000 people at the Seattle-Renton plants during the wartime peak to less than 10,000 in 1946. During this time, as might be expected, every effort was made by the Boeing management to do necessary work in its own shops in order that a nucleus of skilled workers might be retained.

Because of this fluctuating nature of its subcontract requirements, the Boeing Company has not encouraged Northwest firms to increase their productive capacities to handle Boeing work. Rather, it has followed a cautious policy of dealing with established firms known to have the available capacity to do Boeing work. The reason for such a policy is well illustrated by the experience of one firm. During 1951, this firm obtained enough business from Boeing to keep its entire workforce busy, and since the particular work being done was very desirable from the owner's point of view, regular commercial accounts were no longer serviced. At the end of the year, when the contract was completed, the firm was unable to ob-

tain additional work, in part because the type of work the firm could do was no longer needed by Boeing. The firm's managers had extreme difficulty in re-establishing their previous commercial contracts, and even after the passage of two and one-half years had not wholly recovered their lost business. The possibility of this happening to their subcontractors is well recognized by Boeing and subcontractors are urged not to *put all their eggs in one basket*.¹

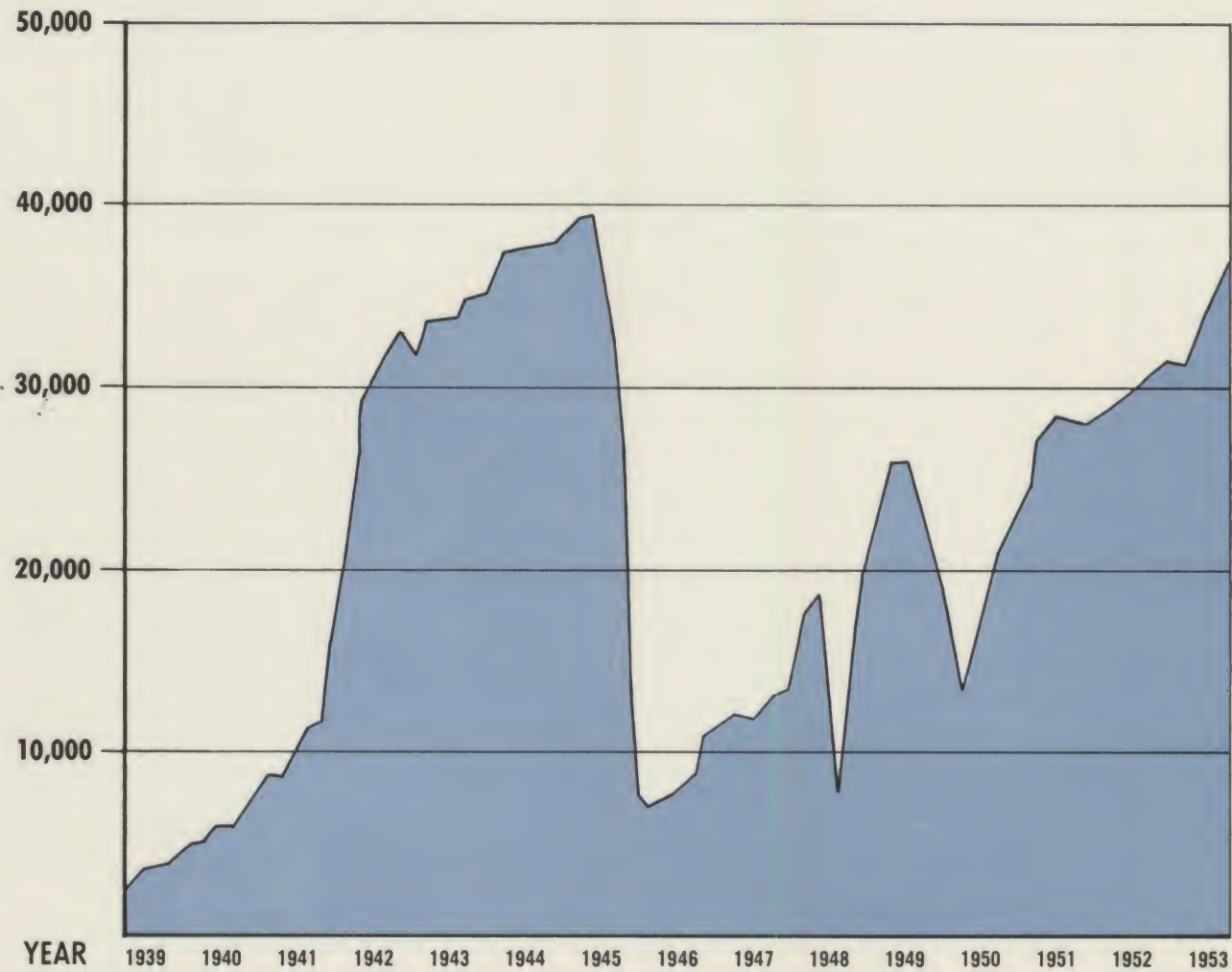
Out of the Committee's study and from the generalizations made in the previous paragraphs, a fairly clear picture emerges of Boeing subcontracting in the Pacific Northwest. Most Northwest subcontractors are small firms by almost any standard of measure. They are relied upon by Boeing as sources of small parts and tooling requirements, and the amount of business so placed has fluctuated sharply in the past 15 years, reaching peaks during World War II and the Korean emergency period, with a decided trough during the years between. For most of the Northwest subcontractors, Boeing work forms a minor portion of their business, and this work is fitted in whenever and wherever it is possible to obtain it.

¹The problems faced by firms acting as subcontractors is well illustrated by the experience of the Worcester Pressed Steel Company described in a recent issue of *Business Week*. See "Make It or Buy It; Which Pays Off?" *Business Week*, July 3, 1954, P. 106.

EXHIBIT 12

Boeing Airplane Company Employment 1939 Through 1953 Seattle Area

EMPLOYMENT



the future of boeing subcontracting in the northwest

During the course of its study, the Research Committee often turned its attention to the future of Boeing subcontracting in the Northwest. Many of the area's manufacturers, particularly metalworking firms, look to Boeing as a desirable source of profitable work. At interviews with Committee members, many Boeing subcontractors made comments concerning Boeing's subcontracting practices. While some seemed to fully understand and accept Boeing purchasing policy, others felt that a larger amount of subcontracting should be done in the Northwest area. It was frequently pointed out to Committee members that the purchase of parts from local sources significantly decreases Boeing procurement problems. It is also argued that during war or emergency periods, local subcontractors are especially important since they decrease the burden on the nation's sorely pressed transportation system.

Northwest subcontractors also point out that if they were, as a matter of Boeing policy, given a certain amount of consistent work, their performance would be considerably improved. During World War II, one of the major problems which aircraft producers faced was assisting

subcontractors to become familiar with, and conform to, the requirements of aircraft quality standards. Northwest subcontractors point out that this disadvantage would not exist should a similar emergency arise in the future if some Boeing work were placed regularly in Northwest plants.

A further advantage to Boeing in utilizing local subcontractors regularly is that they would then give Boeing work a preferred status rather than *sandwiching* it in between work done for commercial accounts. This would improve quality standards and delivery performance.

It was also occasionally argued that a nucleus of Boeing work would enable some firms to purchase special purpose equipment for Boeing which the subcontractor could partially support with work from other sources.

These are strong arguments in favor of Boeing's utilizing local sources for the procurement of subcontract parts. Boeing procurement officials generally accept their validity. Boeing officials further state that other advantages are possessed by local subcontractors. They point out that the transmittal of information back and forth between the prime and the subcontractor is infinitely easier if the subcontractor is adjacent to the prime.

Boeing officials can more readily follow the course of work at the subcontractor's plant, and, if necessary, can arrange technical or other help for the subcontractor on very short notice. They can become intimately familiar with exactly the kind of work that the subcontractor can do best. Because of this knowledge, work assigned to the subcontractor can be *hand-picked*, increasing the efficiency and profitability of the work to the subcontractor, and assuring that delivery dates will be met.

In the face of these arguments for the use of local subcontractors, the question may be raised as to why more subcontracting is not done in the Northwest. In actual practice, although local subcontractors are given preference in many ways difficult of quantitative measurement, the extent to which Boeing can place work with local producers is subject to many limitations. The first, and perhaps foremost, of these limitations, is the fact that the vast majority of Northwest firms just do not have the equipment to do Boeing work. A quotation from the *Boeing Magazine* of April, 1951, quoted previously in this report, will serve to illustrate this point:

Perhaps the least of these difficulties (of placing work in local plants) is the fact that personnel would have to be thoroughly trained in the close

tolerance standards of aircraft manufacturing and inspection. Harder to surmount is the lack of equipment for achieving and maintaining these tolerances: precision measuring instruments, accurate surface plates, gauges of all kinds. Often, too, the small plant has no facilities for inspection, heat treatment, magnaflux, anodizing or plating. The small firm doesn't have them because, in its normal business, it doesn't need them.

With the coming of the jet age, aircraft work has become more specialized. Precision machined parts have replaced many of the sheetmetal parts formerly used in the slow moving planes of World War II. New aluminum alloys are being used, necessitating forming and heat treating equipment often not necessary only a few years ago. Many manufacturers located outside of the Northwest have such equipment, and, in many cases, specialize in aircraft work. Many of them are in the major aircraft producing centers of the country, and can support this equipment with work from several manufacturers. These firms offer stiff competition to Northwest manufacturers with only a limited range of equipment, most of it intended primarily for other types of work.

Some Northwest manufacturers have ceased attempting to get work from Boeing because they are unable to meet this competition. Other firms which do possess equipment which can be adapted to Boeing work often prefer to utilize it for regular commercial work, because it is felt that this type of work is more stable than aircraft work.

Even if Boeing officials were to attempt to follow a policy of consistently placing work with Northwest manufacturers, the fluctuation of work available to the Boeing Company itself would make such a policy difficult to follow. *Exhibit 13* shows the sales of Boeing between 1939 and 1953. Such extreme variations in sales volume and output would make it virtually impossible for the Company to guarantee regular and stable work to any substantial number of subcontractors.

In addition, Boeing must meet the requirement of the Air Force that contracts generally be on a fixed price basis with the use of competitive bids. Such a policy

¹Since it is an established policy of the Air Force to stimulate subcontracting to small manufacturers on the part of aircraft producers, some latitude is allowed the Company in accepting bids from small manufacturers. The Company may occasionally accept a reasonable bid from a small manufacturer even though it may not be the lowest.

dictates that low bids be accepted, regardless of the location of the bidder.¹

In most instances, competition for aircraft work during peacetime is usually severe, and work normally goes to those firms with the most efficient, modern equipment for performing the work, and which specialize in aircraft work. Bids from such producers are difficult for Northwest manufacturers to meet, and as a consequence, a substantial portion of desirable Boeing work is placed in other parts of the United States.

In view of these circumstances, it is unlikely that Northwest subcontractors or potential subcontractors will obtain, during peacetime, an increased amount of Boeing work in the future. As stated before, the production of aircraft parts requires, in many cases, equipment which they do not possess, and which is possessed by producers in other parts of the country. Further, many potential subcontractors located in the Northwest prefer to focus their attention on regular commercial work which, if it can be obtained, is more desirable than Boeing work with its characteristically irregular and unpredictable fluctuations.

Most of the comments made in the previous paragraphs apply to peacetime subcontracting of the Boeing Company in the Northwest.

Should an all-out defense emergency again arise such as existed during World War II, work for the Boeing Company would offer many Northwest firms an opportunity to make a substantial contribution toward the production of essential military aircraft. Competition among major aircraft producers for the services of subcontractors in major aircraft centers over the country would undoubtedly give Northwest firms an advantage in obtaining Boeing work. Many of the larger manufacturers in the area, now producing products of their own, would probably seek Boeing work if deprived of their normal markets because of inability to obtain materials. In the event of such an emergency, the Research Committee felt that firms which wished to be prepared could take several steps in order to become desirable subcontractors. These can be summarized as follows:

- 1.** The development of an organizational structure that can be expanded rapidly in order to meet the needs of all-out defense production.
- 2.** The maintenance of a sound financial condition with adequate methods of controlling and predicting costs.
- 3.** The installation of a labor relations program designed to create a stable workforce with which efficiency could be maintained even under the stresses characteristic of emergency production.

4. The creation of procedures designed to enable the firm to keep abreast of the many laws and regulations which would affect the firm during defense emergency periods.
5. The development of a program of quality control which would permit the meeting and maintaining of the high quality standards required in aircraft work.
6. Lastly, for those firms which can anticipate their entrance into the subcontracting field during an emergency period, some effort should be made to do at least a small amount of regular subcontract work in preparation for such an event. While it is recognized that a program would create many difficulties for those firms whose regular commercial work does not require the standards of quality inherent in aircraft work, a consistent amount of subcontracting even on a small scale would ease the problems of transition from a peacetime economy to that of a wartime one.

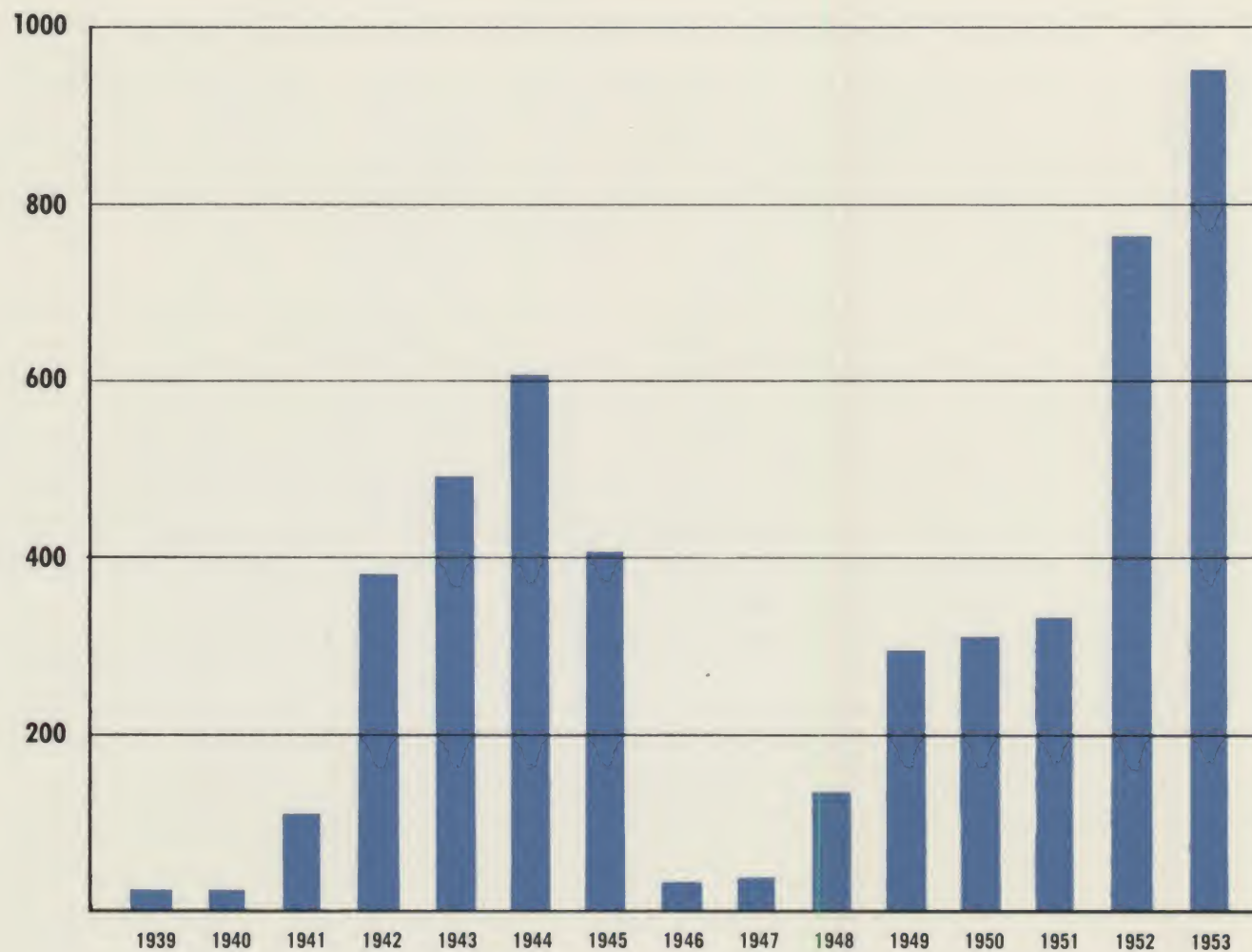
It was felt by the Research Committee that if Northwest firms would meet these requirements, they would be adequately prepared to serve as aircraft subcontractors within the limits of their manufacturing facilities should such a period of all-out defense emergency arise again in the future.



EXHIBIT 13

Annual Sales Volume of the
Boeing Airplane Company
Between 1939 and 1953
(in millions of dollars)

MILLIONS OF
DOLLARS



Additional copies available at \$1.25 each from:

Director of Bureau of Business Research
302 Commerce Hall
University of Washington
Seattle 5, Washington

